AMPR and radar observations from IPHEx: Data quality control and product generation

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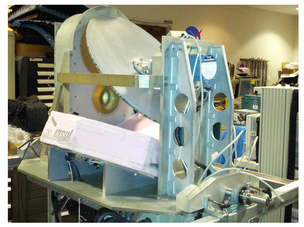
1. Advanced Microwave Precipitation Radiometer (AMPR)

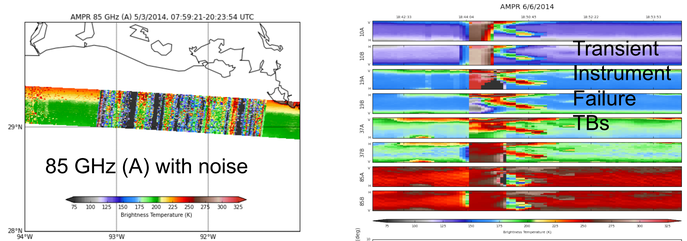
AMPR is a cross-track scanning, airborne passive microwave radiometer maintained by NASA Marshall Space Flight Center. It has four microwave frequencies (10.7, 19.35, 37.1 and 85.5 GHz). Cross-track scanning results in a rotating polarization basis as function of scan angle

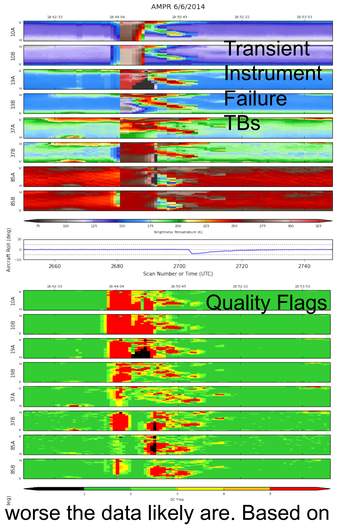
- **Channel A:** Left edge full V, right edge full H
- **Channel B:** Left edge full H, right edge full V



AMPR Instrument in its Marshall Lab

Version 2 AMPR data from the Integrated Precipitation and Hydrology Experiment (IPHEx) are now available. New for IPHEx is that AMPR data are released in Network Common Data Format 4.0 (netCDF4), greatly simplifying data ingest.





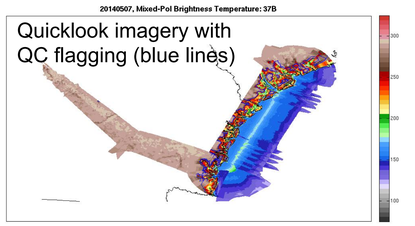
For QC flags, the higher the value the worse the data likely are. Based on 2D behavior of TB values. Sensitive to noise (above left), coastal regions, instrument failures (above right), and sharp gradients near convection

Version 2.0 Data Highlights

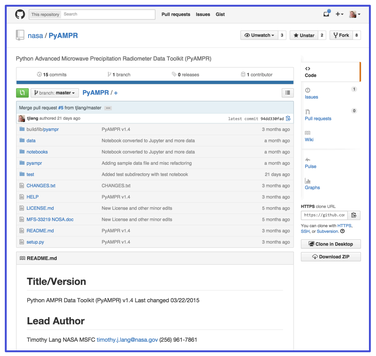
- Data quality flag for each channel
- Incidence angle
- High-resolution land/water fraction (250-m MODIS)

Good Data Characteristics

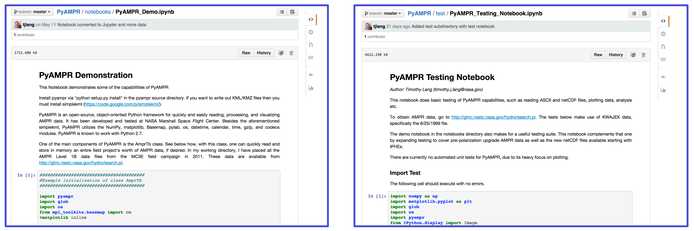
- QC Incidence Angle = 1
- Pixel FOV < 0.1 or Pixel FOV > 0.9, (i.e. mostly land or mostly water)
- QC Flag Value <= 3



Python AMPR Data Toolkit (PyAMPR) open sourced and available on NASA's official GitHub repository. Both Python 2.7 and 3.4 supported.



PyAMPR reads new IPHEx netCDF as well as legacy ASCII-format data from past projects. Demo and testing IPython notebooks available on GitHub



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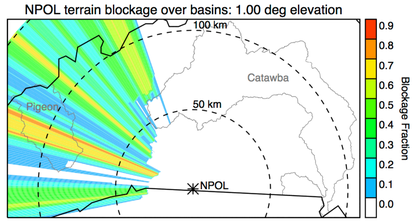
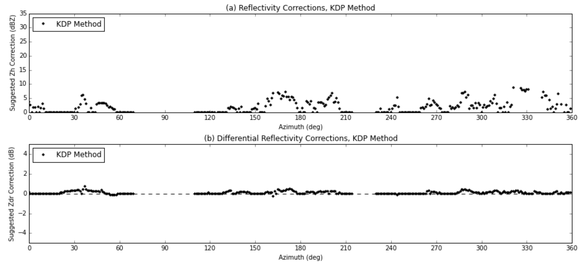
2. NPOL Radar Quality Control and IPHEx Data Fusion

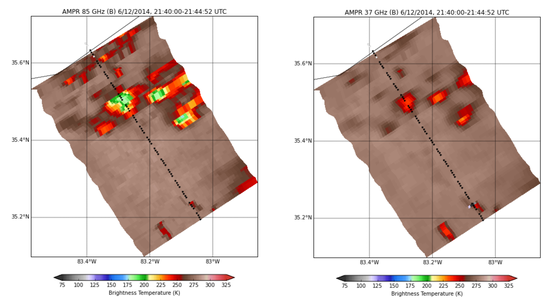
NASA's S-band polarimetric radar (NPOL) was deployed near the SC/NC border during IPHEx. Significant beam blockage from nearby terrain was expected based on pre-campaign modeling. However, observations revealed additional blockage from other obstacles. All of this blockage is in the process being corrected using techniques that exploit the self-consistency of polarimetric radar variables in pure rain (Lang et al. 2009; JTECH). A new Python module (PyBlock) has been developed to simplify this process and is open sourced at https://github.com/nasa/PyBlock.



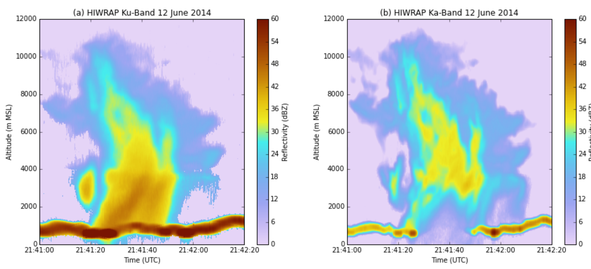
Pre-campaign modeling (left) suggested only blockage to the NW, but actual NPOL observations (right) show significant blockage at additional azimuths

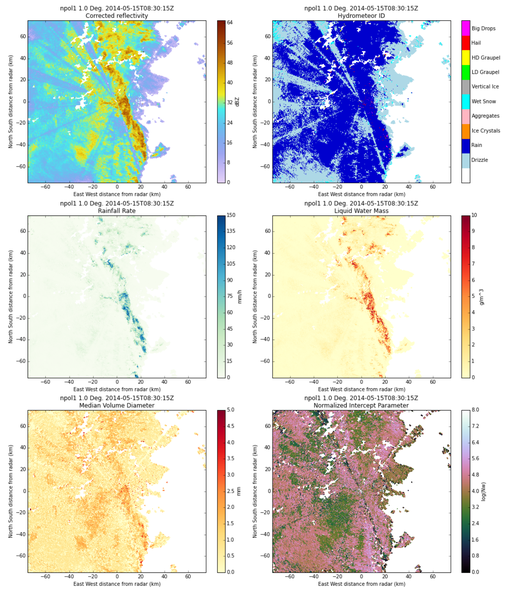


Sample PyBlock output, analyzing corrections needed for reflectivity and differential reflectivity on 15 May 2014.



ER-2 instrument imagery from ~2140 UTC on 12 June 2014. AMPR (above via PyAMPR), HIWRAP (below).

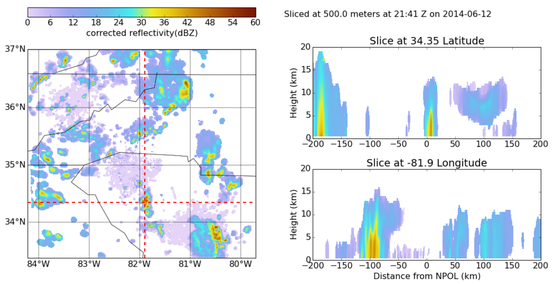




New NASA software (DualPol) interfaces with the DOE Python ARM Radar Toolkit (Py-ART) and CSU retrieval software (CSU_RadarTools) to simplify the estimation of precipitation characteristics from polarimetric radar data.

Data Fusion

Ongoing work is seeking to merge precipitation information (e.g., Z, D0, R, etc.) from multiple platforms to create 4D microphysical grids for the 11-12 June 2014 significant hydrometeorological event



Example of multi-radar data fusion (NPOL + NEXRAD), powered by Py-ART. Precipitation retrievals are gridded along with standard variables like reflectivity.